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ISSN: 2155-9546
Journal of Aquaculture Research & Development

Commentary

Cryobiology and Its Impact on Human Reproduction

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DESCRIPTION

The concept of cryobiology, the study of the effects of low temperatures on living organisms, has revolutionized human reproduction in the last few decades. With the advent of cryopreservation, or the process of freezing and storing biological material, humans can now store and preserve sperm, eggs, and embryos for later use. This technology has given rise to the field of human reproductive cryobiology, which has paved the way for fertility preservation, assisted reproductive technologies, and genetic screening.

History of cryopreservation

The idea of preserving living cells and tissues by freezing was first introduced in the early 1900's. The first successful cryopreservation of spermatozoa was reported in 1949, and the first successful cryopreservation of a human embryo was reported in 1983. Before these breakthroughs, the field of cryobiology had to overcome several challenges, including cell damage caused by ice crystal formation, toxicity from cryoprotectants, and limited understanding of the cellular mechanisms involved in cryopreservation.

Early developments in cryobiology were focused on preserving spermatozoa, which are relatively easy to freeze and store. The first successful cryopreservation of human sperm was reported by P.R. Meryman in 1949. In the following decades, the development of improved cryoprotectants and freezing techniques led to increased success rates of sperm cryopreservation. By the 1970's, sperm banks were established throughout the world, allowing men to store and preserve their sperm for later use.

Cryopreservation of oocytes

In contrast to sperm, the cryopreservation of oocytes, or eggs, has proved to be much more challenging. The main hurdle has been the size and delicate structure of the oocyte, which makes it vulnerable to damage during the freezing and thawing process. Another challenge has been the fact that oocytes contain a large amount of water, which can cause ice crystal formation and cell damage.

Despite these challenges, the first successful cryopreservation of a human oocyte was reported in 1986 by Christopher Chen. Since then, there have been significant advancements in oocyte cryopreservation techniques, including the development of verification, a technique that allows for rapid freezing of oocytes to prevent ice crystal formation. Verification has greatly improved the success rates of oocyte cryopreservation, making it a viable option for women who wish to delay pregnancy or preserve their fertility before undergoing cancer treatment.

Cryopreservation of embryos

The cryopreservation of embryos, or fertilized eggs, has been a major breakthrough in the field of Assisted Reproductive Technologies (ART). The first successful cryopreservation of a human embryo was reported in 1983 by Christopher Chen. Since then, the technology has continued to evolve, with the introduction of improved cryoprotectants and freezing techniques.

Embryo cryopreservation has become an essential component of ART, allowing for the storage and preservation of excess embryos from *In vitro* Fertilization (IVF) cycles. This has allowed for the transfer of embryos at a later date, increasing the chances of a successful pregnancy. Embryo cryopreservation has also enabled the practice of Pre-implantation Genetic Screening (PGS), which involves the testing of embryos for genetic abnormalities before implantation.

Fertility preservation

The development of cryopreservation techniques has also given rise to the field of fertility preservation. Fertility preservation involves the storage and preservation of reproductive cells or tissue for later use. This has become an important option for men and women who wish to delay pregnancy or preserve their fertility before undergoing cancer treatment.

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Received: 05-May-2023, Manuscript No. JARD-23-21204; **Editor assigned:** 08-May-2023, PreQC No. JARD-23-21204 (PQ); **Reviewed:** 22-May-2023, QC No. JARD-23-21204; **Revised:** 06-Jul-2023, Manuscript No. JARD-23-21204 (R); **Published:** 13-Jul-2023, DOI: 10.35248/2155-9546.23.14.808

Citation: Critser B (2023) Cryobiology and Its Impact on Human Reproduction. J Aquac Res Dev. 14:808.